Academic Course Description

BHARATH UNIVERSITY
Faculty of Engineering and Technology
Department of Electronics and Communication Engineering

BEC504 COMMUNICATION ENGINEERING I

Fifth Semester, 2017-18 (Odd Semester)

Course (catalog) description

The course considers analog communication systems and techniques. In this course, we will introduce some of the basic mathematical concepts that will allow us to think in the two "domains" of communications, the time domain and the frequency domain. The course cover the basic types of analog modulation (AM, FM, and PM) from both a mathematical description and from a block-diagram system approach.

Compulsory/Elective course: Compulsory for ECE students

Credit & contact hours **:** 3 & 45

Course Coordinator **:** Mr.R.Mohanraj, Asst. Professor

Instructor(s) **:**

Name of the instructor	Class handling	Office location	Office phone	(domain : @bharathuniv.ac.in)	Consultation
Mr.R.Mohanraj	Second year	SA006		mohanraj.ece	9.00-9.50 AM
Ms.RAJI PANDURANGAN	Second year	SA006		Raji.ece	12.45-1.15 PM

Relationship to other courses

Pre-requisites : Signals and Systems

Assumed knowledge : The students will have a physics and mathematics background obtained at a high school (or equivalent) level. In particular, working knowledge of basic mathematics including differentiation, integration and probability theories are assumed.

Following courses : BEC 604 Communication Engineering II

Syllabus Contents

UNIT 1 AMPLITUDE MODULATION SYSTEMS **9 HOURS**

Need for modulation, Amplitude Modulation System, Single Tone & Multiple Tone Amplitude Modulation, Power Relation, Generation of Amplitude Modulation – Linear Modulation – Collector Modulation method Non-linear Modulation – Square law Modulator, Product Modulator, Switching Modulator - Demodulation of Amplitude Modulation – Envelope Detector, Coherent Detector, VSB, Performance comparison of various Amplitude Modulation System.

UNIT 2 ANGLE MODULATION SYSTEMS **9 HOURS**

Frequency Modulation, Types of Frequency Modulation, Generation of NBFM, WBFM, Transmission BW of FM Signal, Phase Modulation. Relationship between PM & FM, Comparison, Generation of FM Direct Method, Indirect method, Demodulation of FM - FM Discriminators.

UNIT 3 RADIO RECEIVERS **9 HOURS**

Introduction – Functions & Classification of Radio Receivers, Tuned Radio Frequency (TRF) Receiver, Superheterodyne Receiver – Basic Elements, Receiver Characteristics, Frequency Mixers, AGC Characteristics.

UNIT 4 NOISE THEORY **9 HOURS**

Noise, Types of noise, White Noise, Addition of Noise due to several sources in series and parallel, Generalized Nyquist Theorem for Thermal Noise, Calculation of Thermal Noise for a Single Noise Source, RC Circuits & Multiple Noise sources. Equivalent Noise Bandwidth, Signal to Noise Ratio, Noise-Figure, Noise Temperature, Calculation of Noise Figure, Noise Figure Determination for Cascaded Stages of Amplifiers.

UNIT 5 PERFORMANCE OF COMMUNICATION SYSTEMS **9 HOURS**

Receiver Model, Noise in DSB-SC Receivers, Noise in SSB-SC Receivers, Noise in AM receiver (Using Envelope Detection), Noise in FM Receivers, FM Threshold Effect, Threshold Improvement through Pre-Emphasis and De-Emphasis, Noise in PM system – Comparison of Noise performance in PM and FM, Link budget analysis for radio channels.

TOTAL 45 HOURS

Text book(s) and/or required materials

TEXT BOOKS

T1. John G. Proakis & Masoud Salehi, *"Communication System Engineering",* 2nd Edition, 2002.

T2. R.P. Singh & S.D. Sapre, *"Communication Systems: Analog &Digital",* 3rd Edition, Tata McGraw-Hill, 2012.

REFERENCES

R1. Sanjay Sharma, "*Communication Systems Analog & Digital*", S.K.Kataria & Sons, 5th Edition, 2009. R2. Dennis Reddy & John Coolen, *"Electronic Communications", 4th* Edition, Prentice Hall, 2008.

Computer usage: Nil

Professional component

General	-	0%
Basic Sciences	-	0%
Engineering sciences & Technical arts	-	0%
Professional subject	-	100%

Broad area : Communication | Signal Processing | Electronics | VLSI | Embedded

Test Schedule

S. No.	Test	Tentative Date	Portions	Duration
1	Cycle Test-1	August 1st week	Session 1 to 14	2 Periods
2	Cycle Test-2	September 2nd week	Session 15 to 28	2 Periods
3	Model Test	October 2nd week	Session 1 to 45	3 Hrs
4	University Examination	TBA	All sessions / Units	3 Hrs.

Mapping of Instructional Objectives with Program Outcome

The scope of this course is to provide the complete analysis of Analog communications. This knowledge helps them to acquire better application of these principles in Digital communications. The overall objective is to introduce the student to the basics of communication theory. This course emphasizes:	Correlates to program outcome		
	H	**M**	**L**
1. Analog modulation and demodulation techniques.	a,d	c,f,g	
2. Acquiring mathematical understanding of Analog Communication Systems.		a,b,g	
3. Understanding the trade-offs (in terms of bandwidth, power, and complexity requirements)	d	a,b,e	f,j
4. Performance evaluation of communication systems in the presence of noise.	e	a,c,j	
5. Design of practical communication system at the block diagram level under certain constraints and requirements.	i	b,d,f	e
6. Design of practical communication system at the block diagram level under certain constraints and requirements	a	b,d,e	

H: high correlation, M: medium correlation, L: low correlation

Draft Lecture Schedule

Session	Topics	Problem Solving (Yes/No)	Text / Chapter
UNIT 1 AMPLITUDE MODULATION SYSTEMS			
1.	Introduction, Need for modulation	No	[T2] chapter - 5, [R1] chapter -3
2.	Amplitude Modulation System- Generalized derivation with Phasor diagram	Yes	
3.	Amplitude Modulation-DSB-SC,SSB-SC Equations, Phasor diagrams, Power saving calculation	Yes	
4.	Single Tone & Multi Tone Amplitude Modulation, Power Relation.	Yes	
5.	Generation of Amplitude Modulation (DSB-FC)– Linear Modulation – Collector Modulation method.	No	
6.	Switching Modulator	No	
7.	Non-linear Modulation – Square law Modulator ,Product Modulator	No	
8.	Demodulation of Amplitude Modulation – Envelope Detector	No	
9.	Introduction to DSB-SC modulation using product modulator & phase shift method block -Coherent Detector	No	
10.	VSB, Performance comparison of various amplitude modulation systems (Elementary treatment only).	No	
UNIT 2 ANGLE MODULATION SYSTEMS			
11.	Frequency Modulation, Types of Frequency Modulation	No	[T2] chapter – 6
12.	Generation of NBFM	No	
13.	Generation of WBFM	No	
14.	Transmission BW of FM Signal	Yes	
15.	Phase Modulation	Yes	
16.	Relationship between PM & FM& Comparison between PM & FM	Yes	
17.	Generation of FM Direct Method (Parametric variation method using Varactor diode)	No	
18.	Indirect method(Armstrong method)	Yes	
19.	Demodulation of FM - FM Discriminators (Slope demodulator)	No	

Session	Topics	Problem Solving (Yes/No)	Text / Chapter
20.	Demodulation of FM - FM Discriminators (Ratio detector)	No	
UNIT 3 RADIO RECEIVERS			
21.	Introduction – Functions of Radio Receivers	No	[T2] chapter – 6, [R1] chapter - 8
22.	Classification of Radio Receivers	No	
23.	Tuned Radio Frequency (TRF) Receiver	No	
24.	Super heterodyne Receiver	No	
25.	Basic Elements, Receiver Characteristics	No	
26.	Frequency Mixers, AGC Characteristics.	No	
UNIT 4 NOISE THEORY			
27.	Noise, Types of noise, White Noise	No	[T2] chapter– 4, [R1] chapter–2
28.	Addition of Noise due to several sources in series and parallel	No	
29.	Generalized Nyquist Theorem for Thermal Noise, Calculation of Thermal Noise for a Single Noise Source	Yes	
30.	Calculation of RC Circuits & Multiple Noise sources	Yes	
31.	Calculation of Multiple Noise sources	Yes	
32.	Equivalent Noise Bandwidth, Signal to Noise Ratio	No	
33.	Noise-Figure, Noise Temperature,	No	
34.	Calculation of Noise Figure	Yes	
35.	Noise Figure Determination for Cascaded Stages of Amplifiers.	Yes	
UNIT 5 PERFORMANCE OF COMMUNICATION SYSTEMS			
36.	Receiver Model, Noise in DSB-SC Receivers	Yes	[T2] chapter– 5,6 [R1] chapter–7
37.	Noise in SSB-SC Receivers	No	
38.	Noise in AM receiver (Using Envelope Detection)	Yes	
39.	Noise in FM Receivers	Yes	
40.	FM Threshold Effect	No	
41.	Threshold Improvement through Pre-Emphasis and De- Emphasis	No	
42.	Noise in PM system	Yes	
43.	Comparison of Noise performance in PM and FM	No	
44.	Link budget analysis for radio channels.	No	
45.	Link budget analysis for radio channels.	No	

Teaching Strategies

The teaching in this course aims at establishing a good fundamental understanding of the areas covered using:

- Formal face-to-face lectures
- Tutorials, which allow for exercises in problem solving and allow time for students to resolve problems in understanding of lecture material.
- Laboratory sessions, which support the formal lecture material and also provide the student with practical construction, measurement and debugging skills.
- Small periodic quizzes, to enable you to assess your understanding of the concepts.

Evaluation Strategies

Cycle Test – I	-	5%
Cycle Test – II	-	5%
Model Test	-	10%
Assignment /Seminar/online test/quiz	-	5%
Attendance	-	5%
Final exam	-	70%

Prepared by: Mr.R.Mohanraj, Assistant Professor **Dated :**

Addendum

ABET Outcomes expected of graduates of B.Tech / ECE / program by the time that they graduate*:*

a. An ability to apply knowledge of mathematics, science, and engineering

b. An ability to design and conduct experiments, as well as to analyze and interpret data

c. An ability to design a hardware and software system, component, or process to meet desired needs within realistic constraints such as economic, environmental, social, political, ethical, health and safety, manufacturability, and sustainability

d. An ability to function on multidisciplinary teams

e. An ability to identify, formulate, and solve engineering problems

f. An understanding of professional and ethical responsibility

g. An ability to communicate effectively

h. The broad education necessary to understand the impact of engineering solutions in a global, economic, environmental, and societal context

i. A recognition of the need for, and an ability to engage in life-long learning

j. A knowledge of contemporary issues

k. An ability to use the techniques, skills, and modern engineering tools necessary for engineering practice.

Program Educational Objectives

PEO1: PREPARATION

Electronics Engineering graduates are provided with a strong foundation to passionately apply the fundamental principles of mathematics, science, and engineering knowledge to solve technical problems and also to combine fundamental knowledge of engineering principles with modern techniques to solve realistic, unstructured problems that arise in the field of Engineering and non-engineering efficiently and cost effectively.

PEO2: CORE COMPETENCE

Electronics engineering graduates have proficiency to enhance the skills and experience to apply their engineering knowledge, critical thinking and problem solving abilities in professional engineering practice for a wide variety of technical applications, including the design and usage of modern tools for improvement in the field of Electronics and Communication Engineering.

PEO3: PROFESSIONALISM

Electronics Engineering Graduates will be expected to pursue life-long learning by successfully participating in post graduate or any other professional program for continuous improvement which is a requisite for a successful engineer to become a leader in the work force or educational sector.

PEO4: SKILL

Electronics Engineering Graduates will become skilled in soft skills such as proficiency in many languages, technical communication, verbal, logical, analytical, comprehension, team building, interpersonal relationship, group discussion and leadership ability to become a better professional.

PEO5: ETHICS

Electronics Engineering Graduates are morally boosted to make decisions that are ethical, safe and environmentally-responsible and also to innovate continuously for societal improvement.

Course Teacher	**Signature**
Mr.R.MOHANRAJ	
Ms. RAJI PANDURANGAN	

Course Coordinator **HOD/ECE**